Nature's String Stitching Device for the Production of a Language Space

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Abstract

No one has ever been able to look into the language space nor has anyone been able to measure the phenomenon of consciousness without the interference of an observer. This article is changing this situation completely. From now on it is possible to produce measures of consciousness without the presence of classical observation devices. In particular, the observation problem can be bypassed since the "observer" is part of the "observed". This means that the phenomenon is describing itself. Since there is no longer any need for mirroring the state of consciousness by the state of an apparatus, the classical problem of an observation on the apparatus has disappeared. It is shown that the measurement situation has been changed fundamentally. A full description is attainable through the establishment of the geometrical shapes of involuted textual flows.

The Axiomatic Foundation of the Steering and Control Mechanism

A fundamental fact of all living systems is that they are *"self-referential"* and thus that they contain their own description. Further, in departing from the fundamental hypothesis that Nature is the producer of language, this hypothesis requires that the steering and control mechanism, responsible for proper production becomes recognisable. From a strictly scientific point of view it is, however, not sufficient to take the point of departure in Nature. Methodological considerations have to be based on an a-priori assumption. In the present context, the assumed basic principle, underlying all living systems is the following:

AaO → Axiom (1)

The principle, stated in Expression (1) presupposes a dual steering and control mechanism, which is anchored in the A-O-dependency. Further, as the a-priori principle of all living systems, it is the foundation for the establishment of *"synthesis"* and consequently meaning. By this assumption, it is likewise stated that the principle is reflecting Natural Law. However, the reflection requires the introduction of a copy of the principle, which makes it functional:

[AaO] → Functional Axiom (2)

Hence, the functional axiom implies a copying process, which is establishing the biological mechanism underlying natural language production. By this assumption is meant that the principle becomes functional in the moment when a copy of its components is being realised. Functional in Expression (2) refers to the production of a *"standard copy"*. Each time such a copy is being copied, the copying process is carried out irrespective of its meaning.

However, from an evolutionary point of view, it can be stated that irreversible time enters into the process, which makes the mechanism always departing from any strict or uniform reproduction. Hence, the mechanism steadily is producing new forms of expression. This circumstance is symbolised in Expression (3):

[ØaØ] → Incompleteness (3)

When either the A-component or the O-component of the dual steering and control mechanism is missing at the textual level, incompleteness is to hand. It would not be out of place to mention that Expression (3) has far-reaching consequences for the study of language as a phenomenon of nature.

Except that the duplication, according to Expression (2) takes place in strictly mechanical terms, the co-operative interaction between different A's and O's is producing various displacements of the components through their *"dislocation"*. This condition is symbolised as follows:

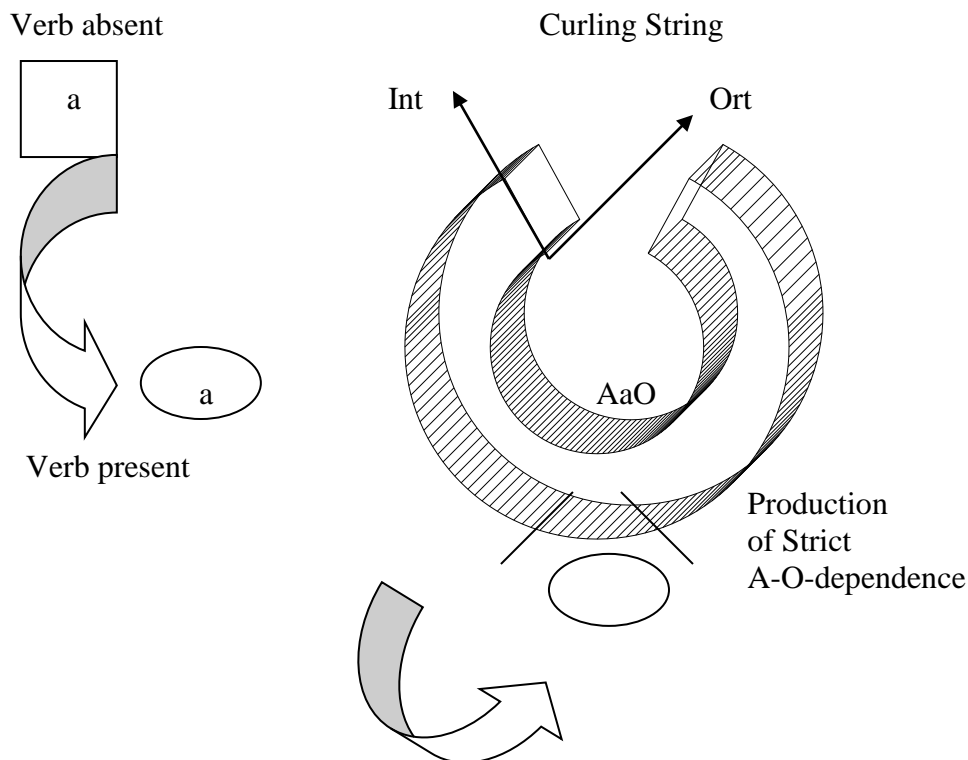[Aa($Ø_A$a$Ø_O$)] → Interacting Sequence (4)

Hence, through dislocation of different components in the order of succession, every new language expression is establishing itself as a new form and the result of novel terminal states. When the language production process is ordering the copies in interacting sequences, irreversible time is governing the process, but this requires that some copies emerge incomplete. This circumstance is influencing profoundly both the evolutionary process that generates radical flow morphologies and the *"channelling"* of the flows, which requires that channels are swiftly formed in order to transport the corresponding textual flows.

Establishment of Completeness

        To be able to identify the A-component presupposes that its identity can be discovered, which is possible only under the condition that a text producer writes something. Getting to know the A-component this way implies that an action becomes real and that its linguistic expression reflects the nature of the action, which is the production of a strict A-O-dependency. However, it is crucial to be able to catch the corresponding movement at the textual level, which is carried out as follows:

Figure 1.

Establishment of Completeness

Verb absent
                                      Curling String

a

Int   Ort

a

AaO

Verb present

Production
of Strict
A-O-dependence

The "curling string" of Figure 1 demonstrates a first measure in the development of a language space. Successful development builds on the identification of the verbs present. Without the presence of a verb no channels can be formed. On the other hand their presence is establishing the ways in which the A's and O's contribute to the development of a space. Hence, the a-component is determining the specific bonding relations, which the participating verbs have produced.

      The curling string. The production of a language space and its effect on developing flow morphologies becomes accessible only if a complete textual surface can be produced. Such a surface requires that the dummies can be supplemented with text segments, i.e., sewed up. But this operation can only be performed under the condition that there is either a thread or a string with which the mechanism can work. Therefore, their production and use must necessarily refer to intentionality (int) as well as orientation (ort). This means at the same time that dimensionality is inherent within the string itself. Further, it becomes identifiable and differentiable in the moment when a grapheme is produced. Hence observing the production

of natural language expressions in a meaningful environment is hardly possible without an intention and orientation. Figure 1 presupposes that the intention can be separated from the orientation. It follows that a grapheme is a suitable marker of an identifiable string. Any string may be associated with some of the components (A, O) and give expression to the variability within each component. The difference of this variability may refer to variance in the complexity of the strings on one hand and to the curling of the strings on the other, which express distance in place and time.

The Ring Structure

The intentional dimension is manifesting a fundamental fact of all living systems, namely to be able to stretch through the co-operative action (a) in order to be adaptive in relation to some objectives (O's). The second dimension indicates the importance of living system's ability to orientate toward a particular Objective (O). However, when the A's and O's reside in the same biophysical system (i.e., an organism), this system must be treated as self-referential. Its functional operations are demonstrated in Figure 2.

Figure 2.

Ring Structure
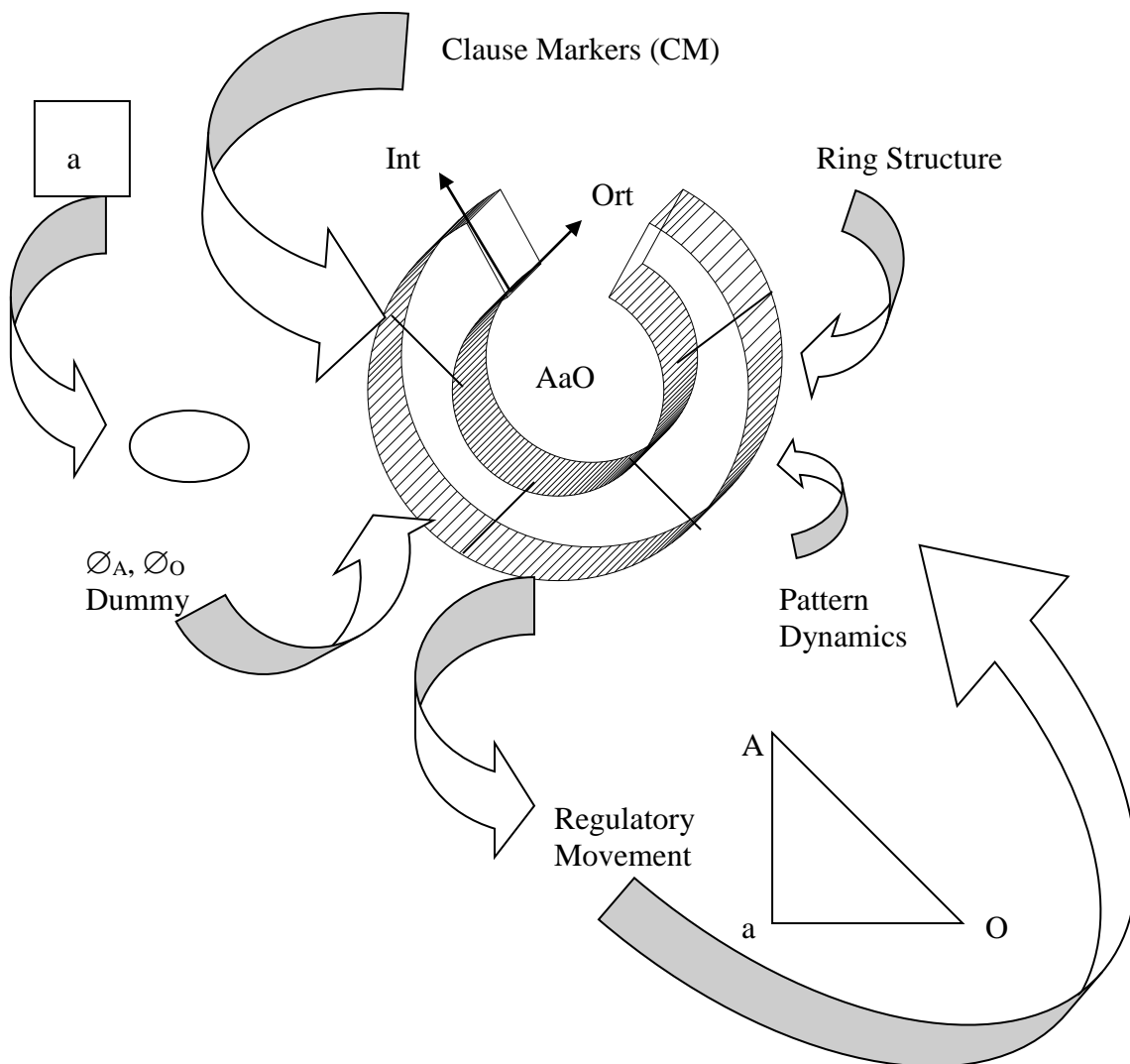
Hence, natural language, conceived of as self-referential system, is organising itself and characterised by a biophysical mechanism, which is developing the structural aspect of a graphical expression in the form of a grapheme and strings of graphemes. It follows that a ring structure is always open to expansion before it is absorbing textual elements. In its function, it is performing either as an indicator of structural relations or as a communicative tool when it is forming the channels of the textual flow. In its latter function, it is always a-posteriori and regulative. But both functions contribute to the development and shape of the language space.

As shown in Figure 2, in case there is a dummy of one or the other type, this means that a textual flow is observable, which is concentrated to those places where the dummies have emerged. As to the channel formation, the dummies mark "holes" in the textual surface, which implies that they may be used to decide upon the character of a particular flow morphology, resulting from the corresponding textual pattern dynamics. Finally, the triangle of Figure 2 marks that two copies have been coupled on the vertical axis. Vertical coupling is a mark of spiralling structure as well as an indication of an evolving configuration, which is the result of a "winding factor" (Winfree, 1980).

The mechanism, obviously, operates in accordance with a pendulum. In its forward or downward move, textual segments are driven into those places, where text is missing. But in the backward or upward move of the pendulum, explicitly integrated textual segments are moved into places, where they stay permanently. It follows that pendular movements create accelerations in textual flows, which are directed toward centres, where the involved textual elements become strongly concentrated.

But even more important is the fact that the pendulum obeys two laws. One requires the mechanism to keep and conserve the strict dependency, which must hold within the A-O-pairs. The other requires that the pendulum always is establishing symmetry. Together, the two laws lead to strict co-ordination, which results in the establishment of "blocks". The "block" concept concerns synchronisation. This means that an A-O-pair within a block remains both co-ordinated and unchanged when exposed to different phase transitions. As may have become evident, a textual agent and a textual objective give expression to a dynamics, which comes about within strict borderlines. Thus far, involved phase dependencies are marked by the "Clause Markers" (CM), which are interlocking the thermodynamic patterning.

Irreversible Time

As a minimum, a block is an expression of both displacements in equal steps and firmness in its evolutionary development by known and unknown order parameters. In addition, block-wise operations do not allow whether a rhythmic or a clock-like rotation within individual components. A liberalisation of the movement patterns of the components would imply that every single component within the pair is following its own autonomous rhythm. By handling this individuality, the system has been capable of establishing two autonomous clocks (the black dots), namely an A-clock governing the A-component and an O-clock governing the O-component. Figure 3 is demonstrating the clocking mood of the mechanism.

Characteristic of the co-operativity of the clocks is that the angle from one to the other is captured in the exponential relation ($e^{i\theta}$), where (i) specifies the intentional plane of the angle of rotation, while ($|\theta|$) specifies the magnitude of the angle and the straight brackets denote the absolute value of the operation. When a certain number of rotations through the angles have been processed, the result appears as "multiplicative redundancy".

Figure 3.

The Clocking Mood

+

A = ϕ = 180º   O = θ = 180º

Irreversible Time

ω=360º

The Ring-Structure

= ϕ_1
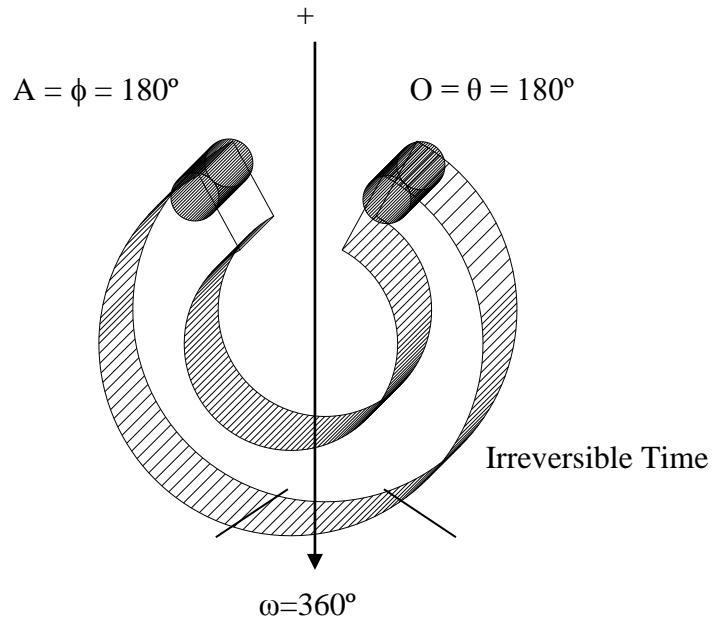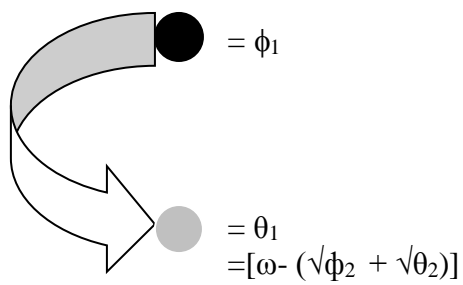
A	Researcher
a	observed
$\varnothing_O$	[infants + on the cliff]
CM	that

= θ_1
=[ω- ($\sqrt{\phi_2}$ + $\sqrt{\theta_2}$)]

= ϕ_2
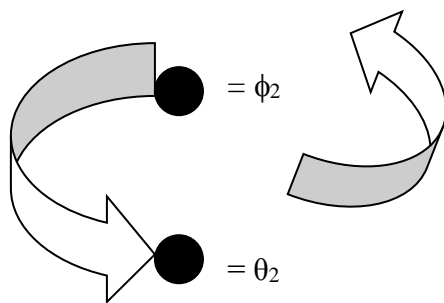
A   infants

a   crawled

= θ_2 O   on the cliff

According to Hestenes (1993, p. 68), this condition can be expressed as [($e^{i\theta}$ $e^{i\phi}$)=$e^{i(\theta+\phi)}$= $e^{i\phi}$ $e^{i\theta}$], which follows from Moivre's theorem [$e^{i\theta,\phi})^n$=$e^{in\theta,\phi}$]. However, the exponential function and its series expansion require that angles become measured in radians (Hestenes, 1993, p. 75).

Related to the text example, it is easily demonstrated that the A-clock in the case of the first clause is initiating a work cycle with a spin of (-½). The same operation applies to the A-component of the second clause. However, the O-clock is initiating work-cycles of different kinds. While the O-clock in the second clause likewise performs a work cycle of a spin of (-½), its operation in the first clause is clearly of a different kind, since the co-ordinative dependency between the clauses is initiating a work cycle with a spin of (-2).

Expressed in geometrical terms, the meaning of the involved rotations is the following: The O-clock first moves one turn counter-clockwise and is thereby establishing zero degrees for the empty place (marked by the dummy). Thereafter, the clock is initiating another turn to mark that the empty place will be filled with a complete functional clause (i.e. the second clause). Since the entire clause constitutes unity (360°), the second turn leads to the establishment of (360°) for the dummy. However, Figure 3 has shown that the involved pendulum moves both components counter-clockwise and in the same direction to eliminate the implied zero point of the first clause.

This operational prerequisite is describing a shadow-like movement, which is indicated by the grey tint of the spot. This condition has to get its operational expression, which means that the original articulation is reduced by the square root of the components, respectively. It follows that the roots of the copied components are subtracted from the angle of articulation at the reference point. This procedure serves perfectly the expression of the implicit parts of a textual flow.

A conclusion to be drawn from Figure 3 is that the rotation of strings of graphemes is driving the rhythmically operating work cycles in the direction toward the sharpest increase in acceleration. Once again, the displacements of grapheme strings can be updated and the change in angular articulation can be calculated without intervening disruptions. Through the clocking mood of the pendulum, it is possible to denote corresponding increases, which finally carry structural significance. Structural significance is addressing the fact that the present approach has not had any use of "free parameters". From a functional point of view, it means that the approach is not fitted into one or the other empirical context. Thus, this fact may be used as a valid basis for an unambiguous and definitive test of the validity of the AaO-axiom.

Experiment

In the text example in Figure 3 is the dummy (Ø) symbolising some environmental or contextual variable, which may be an object or event. In this case it is an event, which incorporates an Agent and an environment. The relation between the two Agents is asymmetrical in the sense that the second Agent is experiencing an unknown environment, while the first Agent already is "knowing" the environment through integrated experiences. Consequently, in his observations (as reported verbally) the knower is always present in the known. Thus, the thesis is that knowing is the result of an active inquiring agent (the knower). Gibson (1979, pp. 156-158) makes the corresponding assumption when he is experimenting with the "Visual Cliff".

As exemplified by the picture series of the Visual Cliff experiments (Gibson & Walk, 1960), the formalism proposed transforms the organism and the environment through a twist into cognition. Thus, inherent in the process of communication is the process of transforming meaningful behaviour into symbolic expressions. At this level, the transformation entwines

the perspective and viewpoints in the same way as organism and environment are entwined at the preceding level of processing. The structure embedded in the caption to the picture series may be visualised as a complementary arrangement of its components in a three-dimensional space. The process, anticipated to operate in this structure, will be demonstrated in Figure 4.

Figure 4.

The Design of the Visual Cliff

-+ a	O		
		−	+
A	−	Stationary Placement (Centre Board	Surface (Visible Support)
	+	Edge (End of Support)	Depth (Invisible Support)

The manipulation of the action component of Figure 4 is manifesting itself through a binding of the values (-,+) to the A and O components respectively. Binding these values with respect to the complementary roles of A and O gives the events described by the picture series of Gibson and Walk (1965, p. 65). All pairings possible in the described event space are (--, -+, +-, ++) and the change of information in the picture series can be studied except for the first combination of symbols. A functional fixation of both organism and environment means sensation and is establishing the zero-hypothesis of perception. The first measure carried out is a fixation of the A-component representing the organism to which the value (-) is bound. The second measure implies a binding of the value (-) right adjusted. The top left picture of the Visual Cliff series is depicting the result (--): A child is placed on the centre of the board.

Gibson's ecological theory of perception presumes that the development of meaning be dependent on the viewpoints being changed. The third measure then implies mobilising the O-component to which the value (+) is bound. More than one viewpoint of the same kind may be observed. No change of perspective is implied. The result (-+) is made visible by the top right picture: The child crawls to its mother across the "shallow" side. Moreover, it is presumed that the observer's perspective can be viewed from various angles. By mobilising the A-component and by fixating the O-component (+-), a change in perspective is observed. The bottom left picture is documenting the result: Called from the "deep" side, the child pats the glass. The final relationship, to be described, can be observed by mobilising both the A- and the O-component (++). The result implies maximal information synthesis, which is pictured bottom right: The inferred behaviour is that the child refuses to cross over to the mother.

The relation (--, ++) and (-+, +-) is complementary to each other. This aspect is indicated by the two contrasting profiles. However the double asymmetry gives every pair a certain control over the development of every other and awareness is determined by re-orientation. Basically the asymmetrical pairs constitute the mechanism for a judgement of one's own possibility to come to solutions allowing an adaptation to fundamental changes.

The Language Space of the Caption to the Visual Cliff Pictures

It is commonly agreed upon that language is a more abstract level of processing than is vision. Nevertheless, a linguistic analysis has to be able to show the language space and to pick up the ecological invariants of this space, although using language-specific instead of vision-specific cues. Based on the caption it is discussed in what way verbal descriptions and textual transformation mediate the integration of experience as invariant structures. The caption is worded as follows:

"CHILD'S DEPTH PERCEPTION is tested on the Visual Cliff. The apparatus consists of a board laid across a sheet of heavy glass, with a patterned material directly beneath the glass on one side and several feet below on the other. Placed on the centre board (top left), the child crawls to its mother across 'the shallow side' (top right). Called from the 'deep' side, he pats the glass (bottom left), but despite this tactual evidence that the 'cliff' is in fact a solid surface, he refuses to cross over to the mother (bottom right)."

Language Space as Function of Textual Movement Production

Whenever observational events structure the language of the observer, this language contains textual movement information, belonging to these events. Therefore, it is assumed that the mechanism has the capacity to reproduce the language space as it is evolving during the generation of the caption.

The unfolded space of the Objective-component. Figure 5 shows the space of the textual objectives. The "objectives/interval" shows the number of objectives (i.e., the sliding within a particular interval), whereas the "intervals" are characterising the naturally occurring periods and fractions of periods the way they have become manifest during text production. The "dynamics", as measured in radians is visualising the accelerations in the rotations as well as temporary reductions. To convert the corresponding scatter plots to mesh plots, the grids have been interpolated with its standard transformation function of SigmaPlot (1998, pp. 290-292). Version 5.0 of SigmaPlot is using an inverse distance method, where the distance weight value (p) has been set as (p = 3). Obviously, an unfolding operation entails the concept of time and its expression through successively increasing and decreasing shades in articulation.

Some outstanding features of the response surface have been marked with corresponding textual elements. The empirical relations of the Objective-component seem to have been packed in such a way that their informational value can be detected. What is substantial and consequently explicit is related to the mother, the shallow side and the cliff. However, the insubstantial and consequently implicit specification of "change" is shown below sea level. The discontinuity in the information flow is marked with the corresponding textual elements, which relate to the deep and the deep side.

The unfolded Space of the Agent-component. Figure 6 depicts the space of the textual agents. By making explicit reference to "tactile evidence", "the child" and "the child's perception" the process in the Agent-component refers to the organism as context for the manifestation of the nature of change. The "unknown" agents (X) are deeper embedded and appear as a matter of fact as implicit and independent of any implications as to context or contents that can be described in terms of sensational attributes. Hence, the informational invariants of the established spaces are assumed to reflect the ecologically significant aspects of the caption.
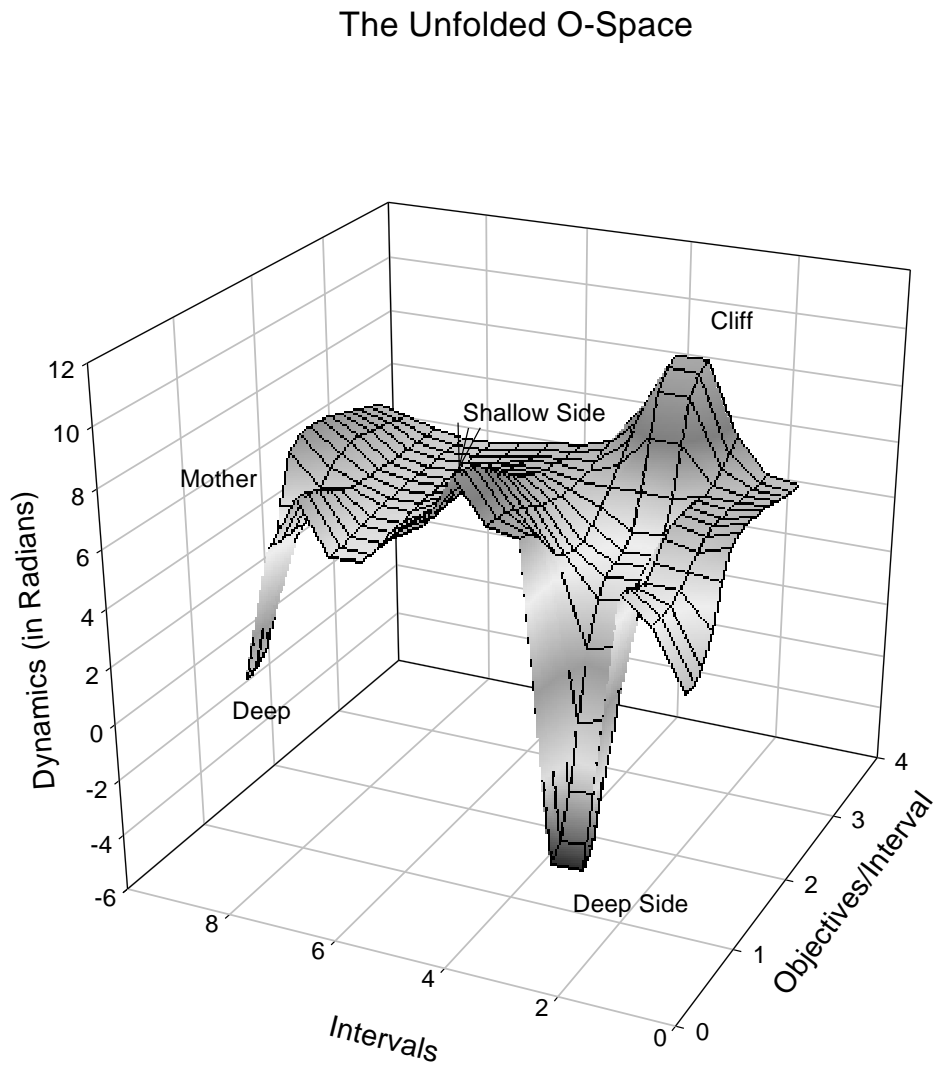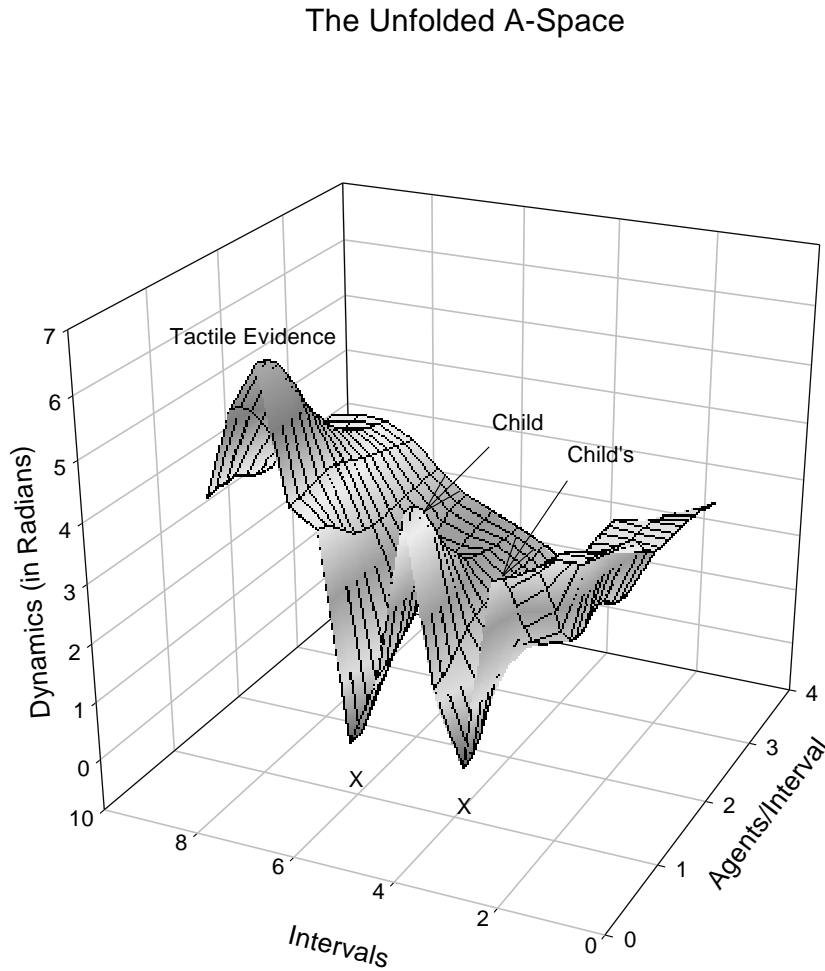
Figure 5.

*The Unfolded Space of the Objective Component*

The Unfolded O-Space

Figure 6.

The Unfolded Space of the Agent-Component

The Unfolded A-Space

Configuration of Informational Invariants as Function of Constraining Space
        The detection of "negative affordances" (Gibson, 1979, p. 157) is in the focus of the caption. However, the implicitness of the experimenters' reason in the caption is manifested below sea level in the child's *"Capacity"* to test the glass surface for its solidity. Obviously, the intention on the simulated cliff is stretching over a series of textual movements. These are folding and producing the synthesis of the caption, which implies its alternative description.
        The folded space of the Objective-component. The structured configuration of the O-space is shown in Figure 7. It concerns the judgement of "Depth" and its consequences for locomotion on the deep side. Synthesis entails that the variety of the involved textual elements becomes specified through terminological profiling.

Figure 7.

The Folded Space of the Objective-Component

The Folded O-Space
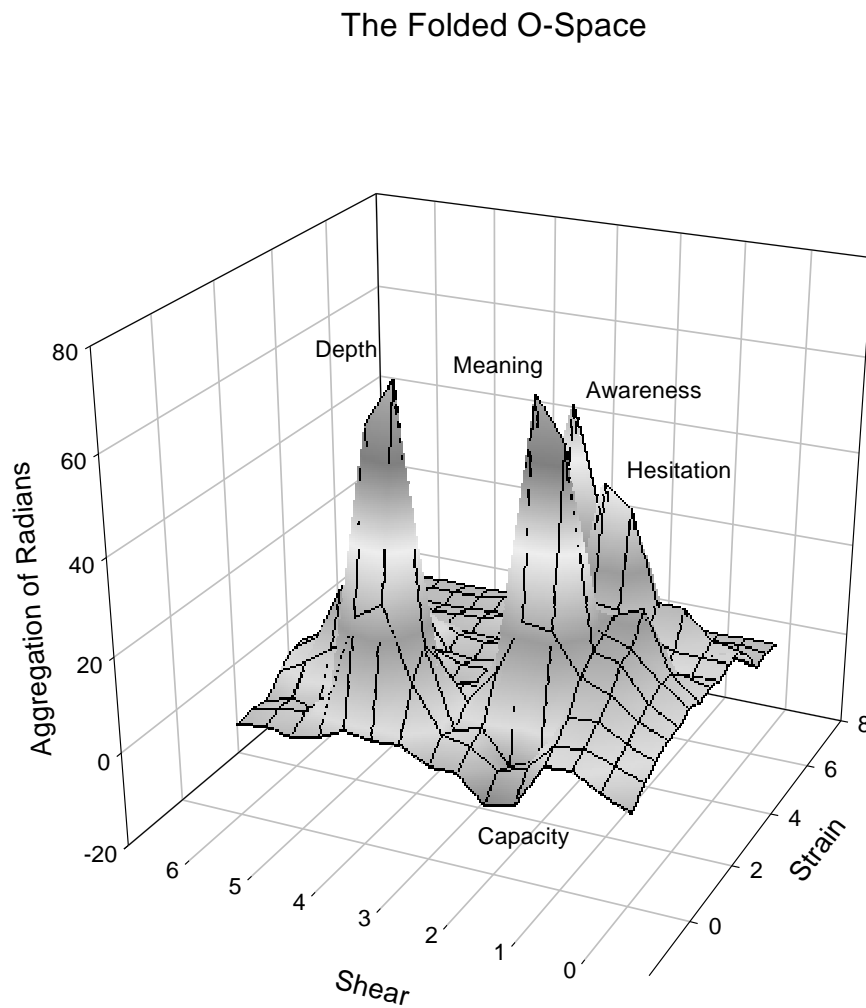
Obviously, the transformational impact of the child's optical information processing is brought to the fore by the three termini *"Meaning"*, *Awareness"*, and *"Hesitation"*. Apparently, the child's grasping of the meaning of a sharp drop has been verbalised successfully. Moreover, the special character and significance of an abrupt changing environment has been related successfully to the dangerous cliff.

Figure 8.

The Folded Space of the Agent-Component
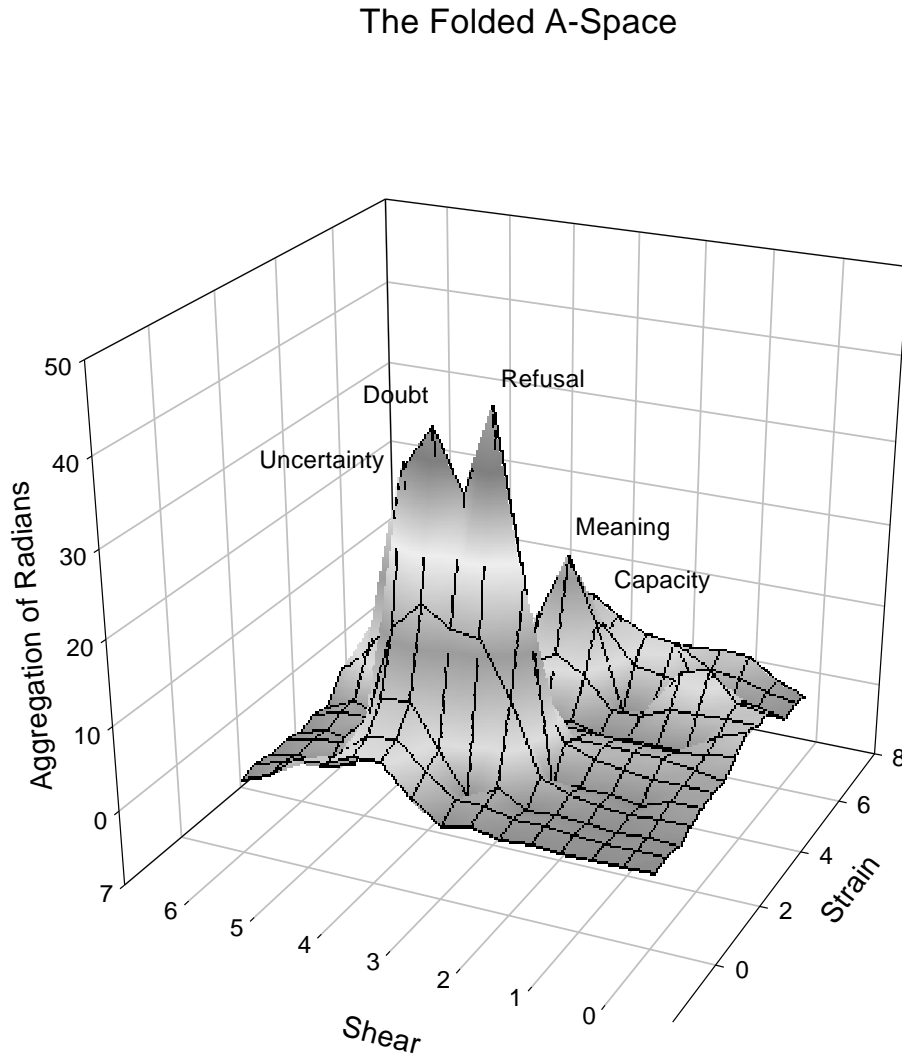
The Folded A-Space

The folded Space of the Agent-component. As indicated by Figure 8, the occurring structure gives evidence to a stressful situation. The caption of the pictured procedure gives expression to the child's experience of a provocation. Its description through the produced termini makes visible that the terminus *"Refusal"* is the theoretically important global state attractor, since its name relates the concept of avoidance as its behavioural ground to the falling-off place of the virtual cliff. The environmental condition in the caption has been formulated in terms of a pertinent change. However, in order to investigate into the *"Capacity"* of the child to perceive directly the *"Meaning"* of the cliff, the caption is giving expression to *"Doubt"* and *"Uncertainty"*. Both seem to be rooted in the child's experience of stressfulness.

Discussion

The central idea of studying the caption to the original Visual Cliff experiments has been to determine the capacity of the experimenters to communicate the knowledge they gained of the effects of the simulated environment. Independent of the degree to which they have been able to formulate it, it has to be communicated through natural language expressions, if it shall become knowable for both the experimenters themselves and for the scientific community at large.

The basic hypothesis of the experiment has been that a subtle interplay between the oscillation of strings and the winding of work cycles is creating the language space. Thus this hypothesis concerns the capacity of the stitching mechanism to handle the subtle distinctions that are created by the textual strings in the process of producing space. At the same time the space hypothesis relates to the fact that the evolving space is restricting the movements of the strings. From the point of view of the experiment, this hypothesis implies that a verbal expression is suitable for processing, provided that it contains cues to its capacity of stretching and straining, and of winding and bending. So, a verbal material has to respond in an elastic way to the evolving dynamic of textual patterns. It is therefore not a coincidence to suggest that a text material must be characterised by flow properties and that these are decisive for the rotational dynamic, and consequently for the textual space being realised.

A consequence of this requirement has been the characterisation of the loss of stability in a text. By this is meant that a scientific study of language as a natural phenomenon must begin with an observation of such losses of stability – in other words a study of discontinuity. Accordingly, an exact characterisation and formal description of cycles of "writing – reading – rewriting" have to be concentrated on a likewise exact characterisation and precise description of the phase transitions connected with the evolving textual space. Finally it is of crucial importance that a test of the basic experimental hypothesis builds on an uncovering and a reproduction of those kinds of order parameters that are restricting the production of a space. The described mechanism has this capacity and therefore, it has been possible to base the experiment on the following methodological properties: (1) manifestation of the acceleration in a rotation and (2) identification of the fundamental order parameters, which are governing the production of a space.

Hence, the theoretical significance of the experiment lies in the determination of the phase transitions involved on the kinetic level and in the determination of the flow morphology of the text at different occasions of change. The changes at different phase transitions are of course influenced by the observations that the text producer has made and communicated. To communicate is a matter of realising both viewpoints as well as a perspective.

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